



**US Army Corps
of Engineers®**

Engineer Research and
Development Center

Ongoing Research

Snow Chemistry

Problem

Snow covers much of the earth permanently or seasonally, acting as both a filter and chemical reactor. In filter mode, snow collects contaminants and chemical tracers from the atmosphere. In regions where snow is ephemeral, contaminants enter surface and soil waters during snowmelt. Continual exchange of air and chemical species between the snow and atmosphere makes the near-surface snow the site of active chemical reactions that affect reactive species such as ozone and hydrogen peroxide, which affect the oxidation capacity of the atmosphere. Also affected are volatile species such as explosive compounds, which may be differentially absorbed and released into the atmosphere according to changes in temperature and weather. Trace metals, aerosols, and dust also are entrained in the snow record.



Collecting a snow sample on the sea ice north of Barrow, Alaska.

Description

A unique aspect of snow is that it provides a history of recent and distant past changes in weather and chemical interactions. Specific layers may be tracked over thousands of kilometers, and the precipitation events they represent yield a time series of deposition ranging from days to thousands of years. Snowfall is a critical component in glacier mass balance

and thus glaciers provide a long-term record of snow and atmospheric chemical composition.

Researchers at the Engineer Research and Development Center's Cold Regions Research and Engineering Laboratory (ERDC-CRREL) in Hanover, New Hampshire, and Fairbanks, Alaska, are conducting ongoing studies in snow chemistry that range from the ice caps of Greenland and Antarctica to the ephemeral snow covers of the Alaskan Arctic and continental United States. These studies are intended to provide a better understanding of the scavenging and deposition of contaminants to the snowpack and their subsequent post-deposition physical and chemical changes.



Temperature-controlled columns of snow samples undergo chemical tests in ERDC-CRREL's coldroom.

Expected Products

Current project goals range from quantifying contaminant migration during spring snow-melt runoff to linking snow chemistry with atmospheric contaminants. The paramount goal of this research is to use chemical tracers to investigate a range of practical cold regions environmental processes.

Potential Users

The snow and ice research community worldwide will benefit from this research.

Projected Benefits

ERDC-CRREL's studies of snow chemistry and contaminants are intended to provide information regarding contaminant migration and transformation, climate change proxies, aerosol contaminant deposition rates, and physical or photochemical alterations.

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